Notice of Allowability	Application No.	Applicant(s)	
	10/039,319	KOCON ET AL.	
	Examiner	Art Unit	
	Paul E Brock II	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment filed May 24, 2004*.

2. ☒ The allowed claim(s) is/are *21-23,25,34-37 and 39-42*.

3. ☒ The drawings filed on *09 November 2001* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Laurence S. Roach on July 19, 2004.

Please amend claims 21and 40 as follows:

21. A process for forming an improved trench MOS-gated device, said process comprising:

(a) forming a doped upper layer on a semiconductor substrate, said upper layer having an upper surface and an underlying drain region;

(b) forming a well region having a first polarity in said upper layer, said well region overlying said drain region;

(c) forming a gate trench mask on said upper surface of said upper layer;

(d) forming a plurality of gate trenches ~~at least one gate trench~~ extending from the upper surface of said upper layer through said well region to said drain region, said gate trenches having sidewalls and floors;

(e) covering said sidewalls and floors with a layer of dielectric material;

(f) filling each of said gate trenches to a selected level substantially

below the upper surface of said upper level with a conductive gate material;

(g) removing said trench mask from the upper surface of said upper layer without removing the layer of dielectric material covering said sidewalls of said trenches;

(h) forming an isolation layer of dielectric material on the upper surface of said upper layer and over said dielectric material covering said sidewalls within said gate trench, said isolation layer overlying said gate material and substantially filling said trench;

(i) removing said isolation layer from the upper surface of said upper layer, a portion of said isolation layer remaining within and substantially filling said trench, and having an upper surface that is substantially coplanar with the upper surface of said upper layer;

(j) forming a plurality of heavily doped source regions having a second polarity in said well region, said source regions extending to a selected depth from the upper surface of said upper layer where said selected depth is substantially coplanar with the level of the conductive gate material in the trench, said step of forming the plurality of heavily doped source regions comprising implanting the entire upper surface of said substrate with ions of said second polarity, then forming a body mask on the upper surface of said substrate;

(k) forming a plurality of heavily doped body regions having a first polarity at the upper surface of said upper layer, said body regions overlying the drain region in said upper layer, said step of forming a plurality of heavily doped body regions comprising doping the upper surface of said substrate with a dopant of said first polarity, then removing said body mask; and

(1) forming a metal contact to said body and source regions over the upper surface of said upper layer.

40. A process for forming an improved trench MOS-gated device, said process comprising:

(a) forming a doped upper layer on a semiconductor substrate, said upper layer having an upper surface and an underlying drain region;

(b) forming a well region having a first polarity in said upper layer, said well region overlying said drain region;

(c) forming a gate trench mask on said upper surface of said upper layer;

(d) forming a plurality of gate trenches ~~at least one gate trench~~ extending from the upper surface of said upper layer through said well region to said drain region, said gate trenches having sidewalls and floors;

(e) covering said sidewalls and floors with a layer of dielectric material;

(f) filling each of said gate trenches to a selected level substantially below the upper surface of said upper level with a conductive gate material;

(g) removing said trench mask from the upper surface of said upper layer;

(h) forming an isolation layer of dielectric material on the upper surface of said upper layer and over said dielectric material covering said sidewalls within said gate trench, said isolation layer overlying said gate material and substantially filling said trench;

(i) removing said isolation layer from the upper surface of said upper layer, a portion of said isolation layer remaining within and substantially filling said trench, and having an upper surface that is substantially coplanar with the upper surface of said upper layer;

(j) implanting the entire upper surface of the substrate and diffusing into the surface of the substrate source dopants having a second polarity to form a plurality of heavily doped source regions that extend into the substrate along the sides of the trenches;

(k) implanting and diffusing into the surface a plurality of heavily doped body regions having a first polarity, said body regions overlying the drain region in said upper layer; and

(1) forming a metal contact to said body and source regions over the upper surface of said upper layer.

2. Please note that the drawing objections in the office action mailed on February 20, 2004 are hereby withdrawn in view of the plurality of trenches depicted in figure 4.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul E Brock II whose telephone number is (571) 272-1723. The examiner can normally be reached on 8:30 AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Paul E Brock II